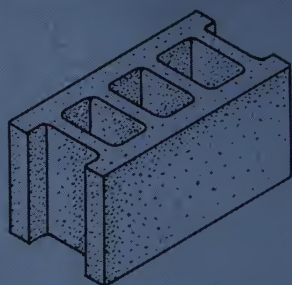


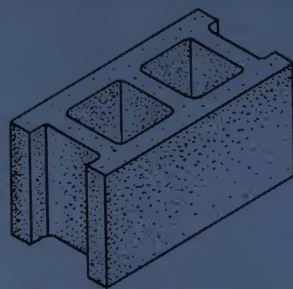
# **Recommended Practices for LAYING CONCRETE BLOCK**



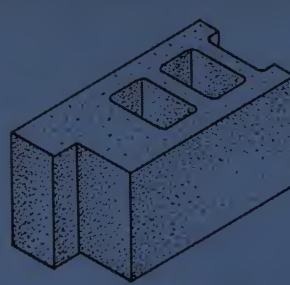
P O R T L A N D   C E M E N T   A S S O C I A T I O N



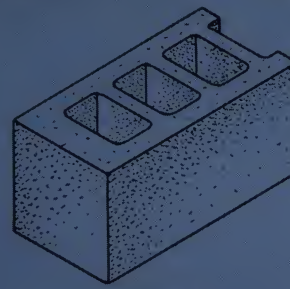
Stretcher (3 core)



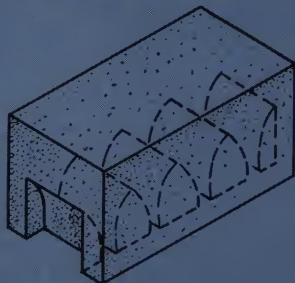
Stretcher (2 core)



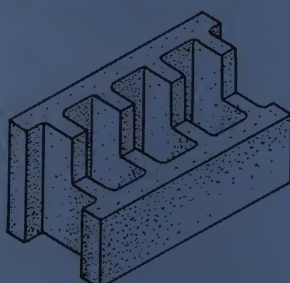
Jamb



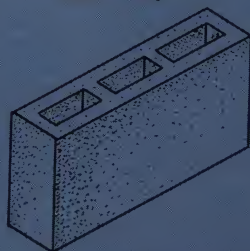
Corner



Solid Top



Header



Partition

Typical Concrete Block

## FOREWORD

USE OF CONCRETE MASONRY is experiencing one of the most remarkable growths of any modern building material. More than two-thirds of the volume of all masonry walls being built today is concrete masonry.

This growing popularity is mainly a result of its adaptability to all types of buildings. From its modest beginning, when concrete masonry was generally restricted to simple and unassuming structures, it is used today in the construction of many of the country's finest homes, apartment buildings, schools, churches and office buildings in which beauty, firesafety, economy and durability are essential.

The use of exposed concrete masonry for finer types of buildings has opened up new fields of construction to the masonry craft. Masons are quick to recognize the opportunities offered by working with this modern building material. Largely responsible for the popularity of concrete block construction is the careful attention given to good workmanship in building neat, clean, straight walls.

This booklet illustrates and describes some of the practices in building a concrete block wall which experienced masons are following and which will result in the highest type of workmanship. Adherence to these recommended practices will result in even greater acceptance and use of concrete masonry construction.

Architects will find this information both a help in preparing specifications and a guide for the inspection of concrete block construction.

### Bricklayers, Masons and Plasterers International Union of America



HEADQUARTERS • BOWEN BUILDING  
815-23 15TH STREET, N.W.  
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Portland Cement Association  
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Gentlemen:

8 September 1954

President Harry C. Bates and I were glad to have had an opportunity to review your new booklet, "Recommended Practice for Laying Concrete Block," during its preparation. The booklet does an effective job of describing and illustrating the steps and practices required to produce high quality concrete masonry construction.

With the increasing use of concrete masonry, our membership is finding that more and more of their time and talents are devoted to laying concrete block. Accordingly, this booklet is a timely contribution to the mason trade. We feel certain that our membership will be greatly benefited by following the recommendations for good workmanship and construction techniques described in this booklet.

If we can be of any assistance in distributing this booklet to our membership, please let us know.

Sincerely,

*John J. Murphy*  
John J. Murphy  
Secretary

JJM:rd

Concrete masonry units are made with such aggregate as sand, gravel, crushed stone, air-cooled slag, coal cinders, expanded shale or clay, expanded slag, volcanic cinders, pumice and scoria. In some localities, the term **concrete block** has been used to designate only those units made with sand and gravel or crushed stone aggregates. Generally speaking, however, **concrete block** refers to hollow concrete masonry units, usually of 8x8x16-in. dimensions, made with aggregate such as those mentioned above.

Some concrete block shown in this booklet may not be available in all areas. Local concrete masonry manufacturers should be consulted as to shapes and sizes available.

Although many of the illustrations in this booklet show the first course of concrete block being laid on a concrete footing, the procedures are the same whether the first course is laid on a footing, foundation wall or on a concrete floor.

The activities of the Portland Cement Association, a national organization, are limited to scientific research, the development of new or improved products and methods, technical service, promotion and educational effort (including safety work), and are primarily designed to improve and extend the uses of portland cement and concrete. The manifold program of the Association and its varied services to cement users are made possible by the financial support of over 65 member companies in the United States and Canada, engaged in the manufacture and sale of a very large proportion of all portland cement used in these two countries. A current list of member companies will be furnished on request.

# MORTAR

GOOD MORTAR is necessary to good workmanship and good wall performance. It must bond the masonry units into a strong, well-knit wall. The strength of the bond is affected by various factors—the type and quantity of cementing material, the workability or plasticity of the mortar, the surface texture of the mortar-bedding areas, the rate of suction of the masonry units, the water retentivity of the mortar—and always the quality of workmanship in laying up the units.

Masonry walls subjected to severe frost action or severe stresses require mortars that are stronger and more durable than walls that are exposed to ordinary service. Mortar mixes shown in the table are recommended for the type of service indicated. Mortar should be mixed in power mixers except for very small jobs where it may be mixed by hand.

Mortar that has stiffened on the mortar board because of evaporation should be retempered to restore its workability by thorough remixing and by the addition of water as required (1). Mortar stiffened by hydration (setting) should be discarded. Since it is difficult to distinguish between these two causes of stiffening, the practical method of determining suitability of mortar is on the basis of time elapsed after initial mixing. Mortar should be used within 2½ hours after original mixing when the air temperature is 80 deg. F. or higher; within

3½ hours when the air temperature is below 80 deg. F. Mortar not used within these time limits should be discarded. Mortar also must be sticky so that it will adhere to the concrete block when it is laid into the wall. When taking a trowel full of mortar from the mortar board, masons often will shake the trowel with a quick vertical snap of the wrist to make the mortar stick to the trowel (2). This keeps the mortar from falling off the trowel when it is applied to the edges of the block.

Block and mortar should be placed on the scaffold near final position to minimize the mason's movements (3).

## Recommended Mortar Mixes

Proportions by Volume

Type of service	Cement	Hydrated lime or lime putty	Mortar sand in damp, loose condition
For ordinary service	1—masonry cement*	—	2 to 3
	or 1—portland cement	1 to 1¼	4 to 6
Subject to extremely heavy loads, violent winds, earthquakes or severe frost action. Isolated piers.	1—masonry cement* plus 1—portland cement	—	4 to 6
	or 1—portland cement	0 to ¼	2 to 3

\*Federal Specifications SS-C-181c, Type II.



1



2



3

# DRY BLOCK

AS SPECIFICATIONS limit the moisture content of concrete block, care must be taken to keep the block dry on the job. They should be stockpiled on planks or other supports free from contact with the ground and covered for protection against wetting (4). *Concrete block must never be wetted before and during laying in the wall (5).*



4



5

## FIRST COURSE

THE MASON, after locating the corners, will often string out the block for the first course without mortar, in order to check the layout (6). A chalked snap-line is sometimes used to mark the footing, thus helping to align the block accurately. A full mortar bed is then spread and furrowed with a trowel to insure plenty of mortar along the bottom edges of the face shells of the block for the first course (7). The corner block should be laid first and carefully positioned (8).

All block should be laid with the thicker end of the face shell up, as this provides a larger mortar-bedding area. For vertical joints, only the ends of the face shells are buttered. By placing several block on end, the mason can apply mortar to the vertical face shells of three or four block in one operation (9). Each block is then brought over its final position and pushed downward into the mortar bed and against the previously laid block, thereby producing well-filled vertical mortar joints (10).

After three or four block have been laid, the mason's level is used as a straightedge to assure correct alignment of the block (11). Block are then carefully checked with the level and brought to proper grade (12) and made plumb (13) by tapping with the trowel handle.

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## LAYING UP THE CORNERS

AFTER THE FIRST COURSE is laid, mortar is usually applied only to the horizontal face shells of the block. This is called face-shell mortar bedding (14). Mortar for the vertical joints can be applied to the vertical face shells of the block to be placed or to the vertical edges of the block previously laid. Some masons butter the vertical face shells of the block previously laid as well as the block to be laid to insure well-filled joints.

The corners of the wall are built first, usually four or five courses higher than the center of the wall. As each course is laid at the corner, it is checked with a level for alignment (15), for being level (16), and for being plumb (17). Each block is carefully checked with a level or straightedge to make certain that the faces of the block are all in the same plane (18). This precaution is necessary to insure true, straight walls.

The use of a story- or course-pole, which is simply a board with markings 8 in. apart, provides an accurate method of finding the top of the masonry for each course (19). Mortar joints for concrete masonry should be  $\frac{3}{8}$  in. thick. Each course, in building the corners, is stepped back a half block and the mason checks the horizontal spacing of the block by placing his level diagonally across the corners of the block (20).



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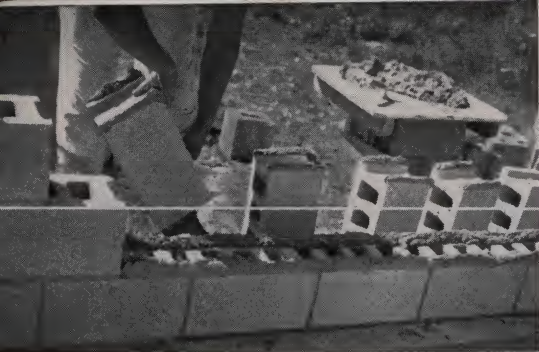
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## LAYING BLOCK BETWEEN CORNERS

WHEN FILLING in the wall between the corners, a mason's line is stretched from corner to corner for each course and the top outside edge of each block is laid to this line. The manner of handling or gripping the block is important. Practice will determine the most practical way for each individual (21). Tipping the block slightly toward him, the mason can see the upper edge of the course below, thus enabling him to place the lower edge of the block directly over the course below (22).

By rolling the block slightly to a vertical position and shoving it against the adjacent block, it can be laid to the mason's line with minimum adjustment. *All adjustments to final position must be made while the mortar is soft and plastic.* Any adjustments made after the mortar has stiffened will break the mortar bond. By tapping lightly with the trowel handle, each block is leveled and aligned to the mason's line (23). The use of the mason's level between corners is limited to checking the face of each block to keep it lined up with the face of the wall.

To assure good bond, mortar should not be spread too far ahead of actual laying of the block or it will stiffen and lose its plasticity. As each block is laid, excess mortar extruding from the joints is cut off with the trowel (24) and is usually thrown back on the mortar board to be reworked into the fresh mortar. If the work is progressing rapidly, some masons apply the extruded mortar cut from the joints to the vertical face shells of the block just laid (25). Should there be any delay long enough for the mortar to stiffen on the block, the mortar should be removed to the mortar board and reworked. The application of mortar to the vertical joints of the block already in the wall and to the block being set insures well-filled joints (26). Dead mortar that has been picked up from the scaffold or from the floor should not be used. In some localities, a full mortar bed may be specified on all concrete block construction. This requires mortar on the cross webs as well as on the face shells (27).



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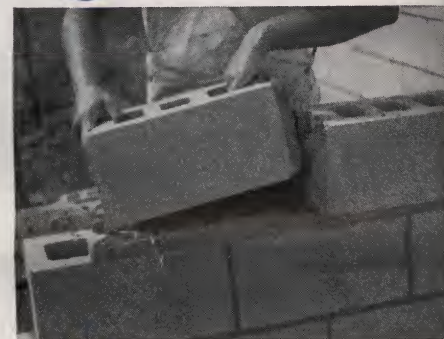
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## CLOSURE BLOCK

WHEN INSTALLING the closure block, all edges of the opening and all four vertical edges of the closure block are buttered with mortar (28). The closure block should be carefully lowered into place (29). If any of the mortar falls out, leaving an open joint, the closure block should be removed, fresh mortar applied, and the operation repeated.

## TOOLING

WEATHERTIGHT JOINTS and neat appearance of concrete block walls are dependent on proper tooling. After a section of the wall has been laid and the mortar has become "thumb-print" hard, the mortar joints should be tooled. The tooling operation compacts the mortar and forces it tightly against the masonry on each side of the joint. Proper tooling also produces joints of uniform appearance with sharp, clean lines. Unless otherwise specified, all joints should be tooled either concave or V-shaped.

The jointer for tooling horizontal joints should be at least 22 in. long, preferably longer, and upturned on one end to prevent gouging the mortar. A suitable handle should be located approximately in the center for ease in handling. For concave joints, a tool made from a  $\frac{5}{8}$ -in. round bar is satisfactory (30). For V-shaped joints, a tool made from a  $\frac{1}{2}$ -in. square bar is generally used (31). Tooling of the horizontal joints should be done first, followed by striking the vertical joints with a small S-shaped jointer (32). After the joints have been tooled, any mortar burrs should be trimmed off flush with the face of the wall with a trowel (33) or removed by rubbing with a burlap bag (34).

*Do not move or straighten the block in any manner once the mortar has stiffened, or even partly stiffened. Final positioning of the block must be done while the mortar is soft and plastic. Any attempt to move or shift the block after the mortar has stiffened will break the mortar bond (34) and allow the penetration of water.*



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## ANCHOR BOLTS

WOOD PLATES are fastened to tops of concrete block walls by anchor bolts  $\frac{1}{2}$  in. in diameter, 18 in. long and spaced not more than 4 ft. apart. These anchor bolts are placed in cores of the top two courses of block with the cores filled with concrete or mortar. Pieces of metal lath placed in the second horizontal mortar joint from the top of the wall and under the cores to be filled (35) will hold the concrete or mortar filling in place. The threaded end of the bolt should extend above the top of the wall (36), and when the filling has hardened the wood plate can be securely fastened to the wall.



35



36

## CONTROL JOINTS

TO CONTROL MOVEMENTS in masonry walls from various kinds of stresses, increasing use is being made of control joints. Control joints are continuous vertical joints built into concrete masonry walls at places where stresses might concentrate. To keep control joints as unnoticeable as possible, care must be taken to build them plumb and of the same thickness as the other mortar joints. If the control joint is to be exposed to the weather or to view, it should be sealed with a knife-grade calking compound. Edges of the masonry in the control joint may have to be primed before calking to prevent the dry masonry from absorbing oils from the compound. Recommendations of manufacturers of calking materials regarding priming should be followed.

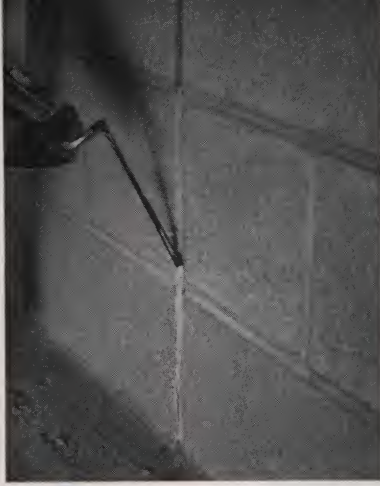
All control joints should be laid up in mortar just as any other vertical joint. If the control joint is to be calked, a recess should be provided for the calking material by raking out the mortar to a depth of about  $\frac{3}{4}$  in. after the mortar has become quite stiff (37). A thin, flat calking trowel is used to force the calking compound into the joint (38).

One type of control joint can be built with stretcher block. Placing a noncorroding metal Z-tiebar 2 in. narrower than the width of the wall in every other horizontal joint will provide lateral support to wall sections on each side of the control joint (39). To form a continuous vertical joint, full- and half-length block are used (40). Sometimes offset jamb block are used at control joints, with a noncorroding metal tie bent in the form of an open Z laid across the joint (41). Another type of control joint can be constructed with building paper or roofing felt inserted in the end core of the block and extending the full height of the control joint. The core is then filled with mortar for lateral support (42). The paper or felt, cut to convenient lengths and wide enough to extend across the joint, prevents the mortar from bonding on one side of the joint, thus permitting the control joint to function (43).

A control joint block available in some areas provides lateral support by means of tongue-and-groove-shaped ends of the block (44). These control joint blocks are also made in full- and half-length units (45).



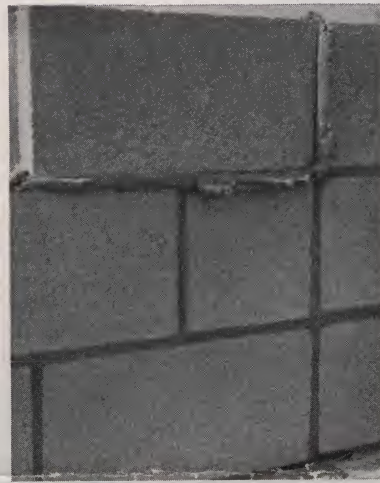
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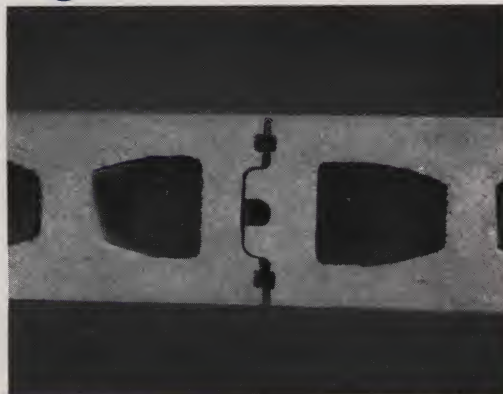
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## INTERSECTING BEARING WALLS

INTERSECTING CONCRETE BLOCK bearing walls should not be tied together in a masonry bond, except at the corners. Instead, one wall should terminate at the face of the other wall with a control joint at that point. For lateral support, bearing walls are tied together with a metal tiebar  $\frac{1}{4}$  in. thick,  $1\frac{1}{4}$  in. wide and 28 in. long, with 2-in. right angle bends on each end (46). These tiebars are spaced not over 4 ft. apart

vertically. The bends at the ends of the tiebars are embedded in cores filled with mortar or concrete (47). Pieces of metal lath placed under the cores support the concrete or mortar filling (48).

If the control joint at the intersection of the two bearing walls is to be exposed to view or the weather, it should be constructed and sealed with a calking compound as described under CONTROL JOINTS.



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## INTERSECTING NONBEARING WALLS

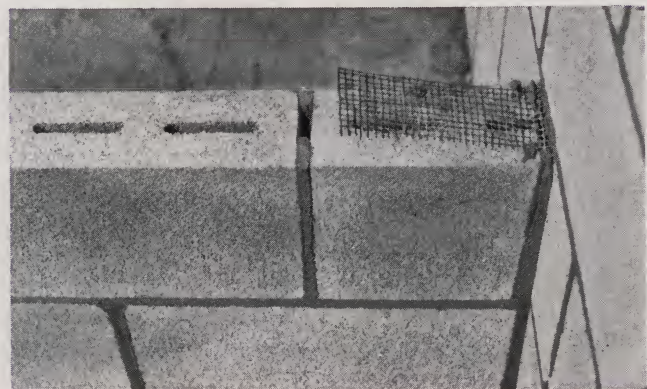
FOR TYING NONBEARING block walls to other walls, strips of metal lath or  $\frac{1}{4}$ -in. mesh galvanized hardware cloth are placed across the joint between the two walls (49). The metal strips are placed in alternate courses in the wall. When one wall is constructed first, the metal strips are built into the wall and later tied

into the mortar joint of the second wall (50).

Where the two walls meet, the vertical mortar joint is raked out to a depth of  $\frac{3}{4}$  in. if it is exposed to view in the finished building, and calking compound is packed into this recess as described under CONTROL JOINTS.



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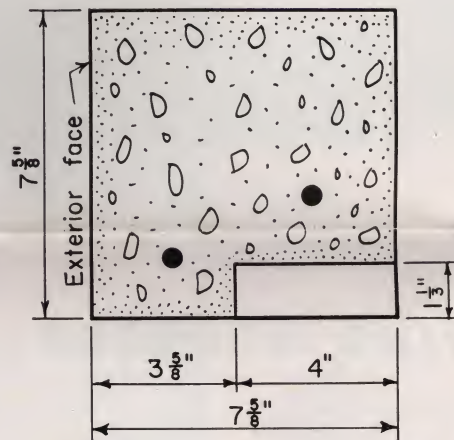
## LINTELS AND SILLS

PRECAST CONCRETE lintels are often used over door and window openings (51). For modular window and door openings, precast concrete lintels are designed with an offset on the underside (52). Steel angles are also used for lintels to support block over openings. To fit modular openings the steel lintel angles must be installed with an offset on the underside (53). A noncorroding metal plate, placed under the ends of lintels where control joints occur, will permit lintels to slip and the control joints to function properly (54).

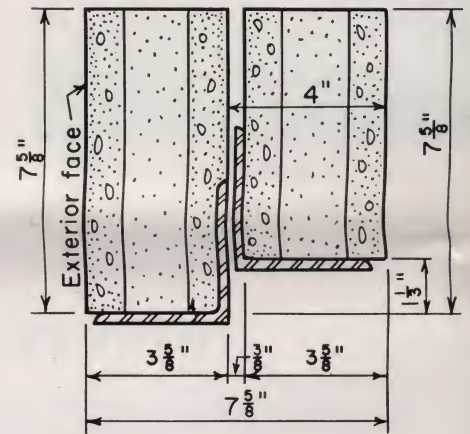
A full bed of mortar should be placed over this metal plate to distribute uniformly the lintel load. After the mortar in the vertical control joint, at the end of the lintel and under the lintel has hardened sufficiently, it should be raked out to a depth of  $\frac{3}{4}$  in. and then filled with a calking compound (55) as described under CONTROL JOINTS. Precast concrete sills are usually installed after the masonry walls have been built (56). Joints at the ends of the sills should be tightly filled with mortar or with a calking compound.



51



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## SPECIAL CORNERS

WHERE L-SHAPED corner block are available for walls thicker than 8 in., they should be used in constructing the corners (57). Where they are not available, the corner can usually be laid up with an 8x8x16-

in. corner block on the outside corner and a concrete brick on the inside corner (58). The concrete brick, well buttered with mortar, can be slid into place to complete the corner detail (59).



57



58



59

## FOUNDATION WALLS

FOUNDATION WALLS of hollow concrete block must be capped with a course of solid masonry to help distribute the loads from floor beams and to act as a termite barrier. Solid top block, in which the top 4 in. is of solid concrete, are available in some areas (60). When stretcher block are used, a strip of metal lath wide enough to cover the core spaces is placed in the mortar joints under the top course (61). The cores are then entirely filled with concrete or mortar and troweled smooth (62). Sometimes 4-in. solid units are used to cap concrete block foundation walls (63). All vertical joints must be completely filled, and slushing of joints should not be permitted.



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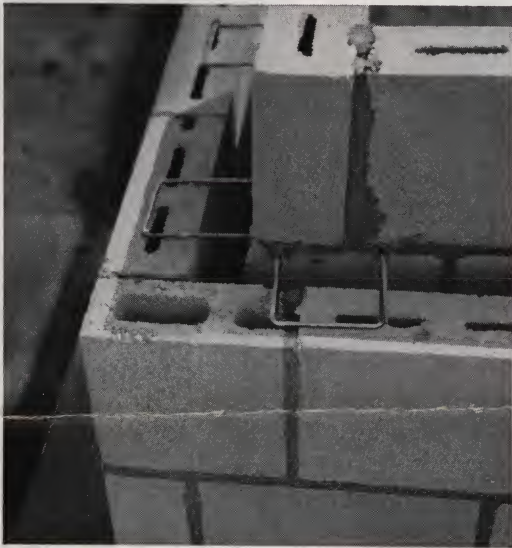


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## CAVITY WALLS

A CAVITY WALL consists of two walls separated by a continuous air space and securely tied together with noncorroding metal ties embedded in the mortar joints. Ties should be rectangular in shape, made from No. 6 gage wire and placed every 16 in. vertically and every 24 in. horizontally (64). When weepholes are required at the bottom of cavity walls, approved flashings should be used to keep any moisture which might

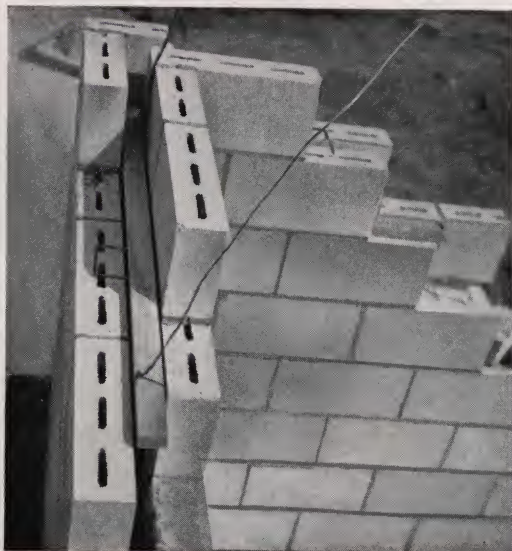
collect in the cavity away from the inner wall (65). Weepholes can be formed by placing well-greased sash cord or rubber tubing in the horizontal mortar joints and pulling them out after the mortar has hardened. To keep the cavity clean, a 1x2-in. board is laid across a level of wall ties to catch mortar droppings (66). The board can then be raised, cleaned and laid in the wall at the next level (67).



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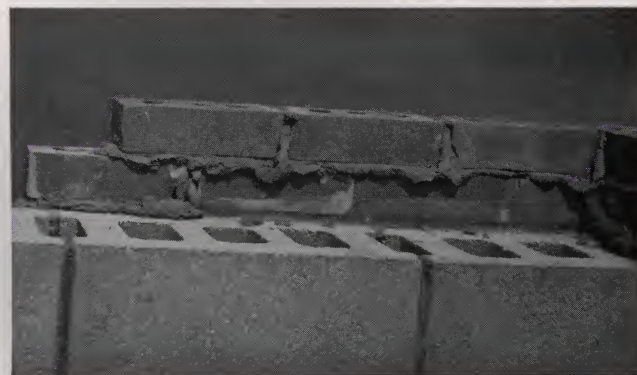
## 8-IN. WALL WITH CONCRETE BLOCK BACKUP

CONCRETE BLOCK is commonly used as backup for various facing materials such as brick and stone. In an 8-in. wall the first course of facing can either be a header (68) or a stretcher course. All facing courses should be laid in a *full* mortar bed and with head joints *completely* filled. Extruded mortar joints on the back face of the facing units should be cut flush before the mortar has a chance to harden (69); otherwise, any parging done over the hardened mortar may break the bond in the mortar joints and result in a leaky wall (70). When parging the facing, a level is often used to prevent the facing from becoming dislodged and breaking the bond in the mortar joints (71). If the concrete masonry backup is laid first, the face of the block should be parged before the facing is laid (72).

In an 8-in. wall, facing headers are laid every 7th course to bond the facing with the backup (73).



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## 12-IN. WALL WITH CONCRETE BLOCK BACKUP

IF THE BRICK FACING is laid up first, the back of the facing should be parged with mortar (74). Some masons apply hand pressure to hold the brick facing in place when parging. With 6th-course bonding, the brick headers bond with the 8-in. concrete header block (75). The concrete block backup is laid in vertical and horizontal face-shell mortar bedding. To insure straight, plumb walls, the block backup, as well as the facing, should carefully be checked with the level when building up the corners (76). A mason's line stretched tightly between corners will serve as a guide when filling in between corners. Brick facing must be laid in a full mortar bed with *full* head joints. Mortar joints, when "thumb-print" hard, should be compacted firmly by tooling. If the block backup is laid up first, parging of the block will help to insure weathertight construction (77). The notched shape of the concrete header block permits bonding of the facing headers and the backup (78).

*6th-course bonding—header up*—Concrete header block can be laid in 6th-course bonding with the recessed notch either up or down, depending upon job conditions. In 6th-course bonding, header up, the brick facing, as always, is laid in full mortar bedding and full head joints (79). Block backup is laid in horizontal and vertical face-shell mortar bedding (80). Whichever is laid up first, the facing or the backup, parging should be applied to insure weathertightness.

*7th-course bonding*—In a 12-in. wall using 7th-course bonding, the block backup consists of stretcher block only. Concrete brick should be used as backup to the brick headers (81).



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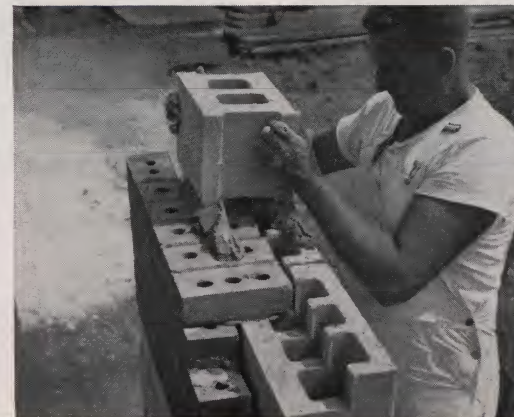
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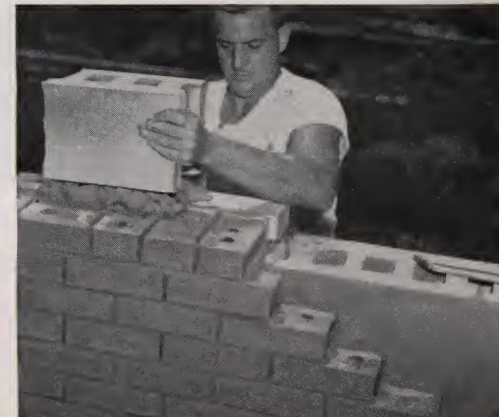
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## PATCHING AND CLEANING BLOCK WALLS

ANY PATCHING of the mortar joints or filling of holes left by nails or line pins should be done with fresh mortar.

Particular care should be taken to prevent smearing mortar into the surface of the block. Once hardened, embedded mortar smears can never be removed and they detract from the neat appearance of the finished wall. Paint cannot be depended upon to hide mortar smears. As concrete block walls should not be cleaned with an acid wash

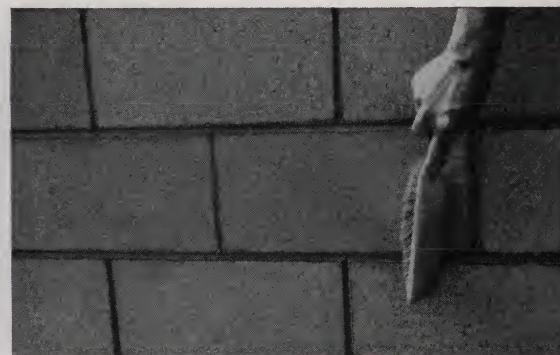
to remove mortar smears or mortar droppings, care must be taken to keep the wall surface clean during construction. Any mortar droppings that stick to the block wall should be allowed to dry before removal with a trowel (82). The mortar may smear into the surface of the block if it is removed while soft. When dry and hard most of the remaining mortar can be removed by rubbing with a small piece of block (83). Brushing the rubbed spots removes practically all of the mortar (84).



82



83



84

## CUTTING BLOCK

CONCRETE MASONRY units usually are available in half- as well as full-length units. However, to fit special job conditions it is sometimes necessary to cut a block with a brick hammer and chisel. The block is scored on both sides to obtain a clean break (85). For fast, neat cutting, masonry saws are often used (86). Block should be cut dry when masonry saws are used so as not to increase the moisture content of the block.



85



86

87

## PROTECTION

BOARDS, BUILDING PAPER or tarpaulins are used for coverings for the top of the block walls at the end of the day's work to prevent rain or snow entering the cores (87).



# WATERTIGHT BASEMENTS

AFTER THE CONCRETE MASONRY basement walls have been constructed, the earth side of the wall should always be given two ¼-in. thick coats of plaster. Either portland cement plaster (1 : 2½ mix by volume) or the mortar used for laying up block should be used for this purpose.

The wall surface should be dampened but not soaked with water, preferably with a water spray prior to the application of the first coat of plaster, to prevent block from absorbing water from the plaster and to assure a better bond. Do not dampen the wall too far in advance of the application of the plaster.

The first coat of plaster, or scratch coat, should extend from 6 in. above the finished ground line down to the top of the footing (88). After the scratch coat has partially hardened, the surface should be roughened with a scratcher (89) to provide a good bond for the second coat. The first coat of plaster should be allowed to harden for at least 24 hours before applying the second coat. Just prior to the application of the second coat the roughened first coat should be dampened with water (90) but not soaked. The second coat of plaster should be troweled on firmly to insure a good bond with the first coat (91) and should extend down over the edge of the footing to form a smooth cove (92). This cove will help prevent water from collecting around the juncture of the wall and footing and thus make a more watertight joint. The second coat of plaster should be kept damp for at least 48 hours to insure proper curing.

In poorly drained soils the plaster should be covered thoroughly with a hot bituminous material brushed on (not sprayed) in two continuous coats over a suitable priming coat (93). The second coat should be applied with brush strokes at right angles to those of the first coat.

Except in sections of the country having dry climate or where the subsoil is well drained, a line of concrete drain tile should be placed around the outside of the footing and connected to a suitable outlet. Joints between tiles should be protected with pieces of building felt, and the tile should be covered with at least 12 in. of coarse gravel or crushed stone (94) prior to backfilling.



88



89



90



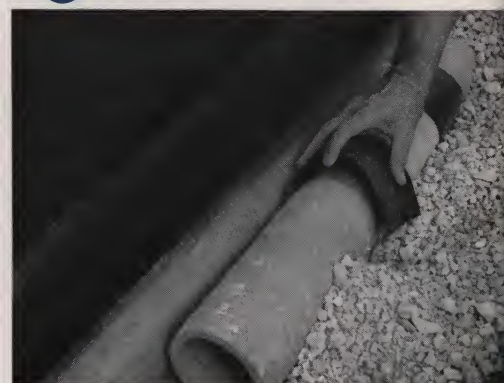
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# WATERTIGHT BASEMENTS



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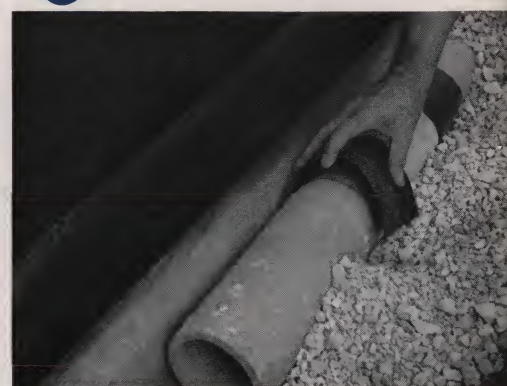
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